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WATER SOFTENING AS A FACTOR IN MUNICIPAL SUPPLY[1]

By Wm. M. Barr[2]

Some of you may be familiar with the story of the southern colonel of Civil War days who was present at a banquet where the committee in charge decided to play a practical joke upon him. The committee asked the colonel to respond to the toast "Water" and while they expected in this way to embarrass him, the old gentleman was equal to the occasion and replied somewhat in this fashion:

> Gentlemen: You have asked me to respond to the toast Water, one of the most abundant and most useful of all God-given commodities. I have seen it standing on the lids of infancy, and coursing down the wrinkled cheeks of age. I have seen it on the petal of the rose as it appeared as dew and glistened in the morning sunlight. I have seen it falling as rain-drops quenching the vegetation of a thirsty land. I have seen it in the babbling brook as it rippled over its stony bed on its way to join the great river. I have seen it in the great river sweeping majestically onward toward the sea. And there I have seen it in the broad expanse of the ocean on whose bosom floats the commerce of the world, but gentlemen, I wish to say to you here and now that as a beverage, it is a rank failure.

The colonel's statement is not quite true at the present time as water as a beverage has come into its own, all other beverages of merit having been prohibited by statute.

However, if I were to paraphrase the colonel's remarks, I believe that the majority of the residents in the middle west who are compelled to use such hard waters as most of us do would agree with me when I say that as a vehicle for washing purposes, water is a rank failure.

It is almost an axiom that a good water supply is essential to the prosperity of a municipality. Great improvement has been made in recent years in the quality of water supplied even in the smaller towns and villages of the country. This improvement has been largely the result of the growing understanding of the direct benefit to be derived in the health of the people by the use of good water. It is natural then that the first great improvement has been along sanitary lines. There is no longer any excuse for epidemics of typhoid resulting from contaminated water supply, since modern methods of sterilization assure us a safe water at a nominal expense.

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[1] Read before the Iowa Section meeting at Omaha, Nebraska, November 2, 1921.

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Frequently, however, an adequate volume of water cannot be had except from streams which may not only be polluted by organisms but usually carry a considerable quantity of suspended matter, which makes the water distasteful in appearance as well as unpalatable. This condition has also been improved by filtration, which in combination with sterilization has been brought to such a degree of efficiency that it is within reach of even the smaller communities. As civilization advances our demands are more exacting and all of our requirements reach a higher and higher plane as the possibilities for satisfying requirements are made easier.

While public officials have given considerable attention to sanitation and to public health, by delivering to the people a safe water and one of good appearance, it is rare to find city officials considering the comfort of the housewife, the convenience of the manufacturer or the economics of his factory when making provisions for municipal water supply.

Some of our cities have been especially blessed by nature by having a pure, clear, cold, soft water delivered almost at their doors under ample pressure, with nothing left to be done but to install the distributing system. Such a city is Portland, Oregon, where the melting snows of Mount Hood collect in a natural reservoir and discharge into a stream at an elevation far above the city. This stream is well protected and the pipe line collects the water at such an elevation as to give satisfactory distribution. This water is as near to absolute purity as nature can supply.

Analysis shows less than 1.5 grains of dissolved mineral solids per gallon, with practically no organic matter. This is an ideal water for all purposes and is one of the cheapest supplies in the country. The absence of hardness in this water makes the soap consumption of this city one of the lowest in the country.

Other cities have had to bring their water hundreds of miles at great expense to provide even a safe water supply of ample proportions. Los Angeles brings its water from a source 265 miles distant at enormous cost, but it has a good sanitary supply. This water contains 1.65 pounds of soap destroying material per 1000 gallons of water. This will consume 1.1 pounds of good laundry soap costing 10 cents or more. If used for household purposes this must be added to the cost of the water.

Omaha city water contains about 3 pounds of soap destroying material per 1000 gallons of water, although it varies considerably with the season and at times contains more than this. For a little more than 1 cent per 1000 gallons most of the carbonate hardness could be removed and the soap consumption be reduced thereby at least 60 per cent.

The same is true of most of the cities using Missouri River water. As coagulation is required on this water, demanding large settling capacity, it is only necessary to add the proper equipment for feeding lime.

It has been estimated that it would cost the City of Omaha $150 per day to treat the water as suggested. If 10 per cent of the total supply is used with soap there would be a saving of $500 per day in the cost of soap, to say nothing of the comfort and convenience derived from soft water.

While waters from middle western streams are looked upon as being unusually hard, there are some towns even less favorably located where underground waters are used. While the water is perfectly clear and sanitary it carries so much material in solution that the stranger wonders what the people in that locality do when they want a bath.

If a manufacturer is considering the possibility of a new location, the city having a pure soft water will be given preference over the one having a hard water, assuming that other conditions are equal. It is, therefore, to the advantage of a community as a whole to offer a satisfactory industrial water supply to those who are seeking locations for new industries. But the manufacturer is not the only one to be considered, nor should it be so. If you consider the greatest good to the greatest number, we should reach all classes of citizens and there are few in any community who do not use soap. If there be such I will venture to say he would not object to taxation on that ground.

The comfort and economy of the housewife affects the whole people, and there is no improvement that would meet with more favor in the community than the production of a soft water from one that has been disagreeably hard.

Many people will say that softening a municipal supply is too expensive. The city of St. Louis has not found it so, and they produce more than a hundred million gallons of soft water per day. It is a noteworthy fact that people going to that city from many other middle western points comment favorably upon the soft character of that city's water supply. The total hardness is reduced approximately 60 per cent. I do not mean that it would be feasible to remove all of the scale forming salts from the city supply, but the removal of the carbonate hardness makes a vast difference in the washing qualities of water, and adds much to the comfort of the people, and while the people may pay a premium on such a water they are simply transferring the charge to the water account from the soap account. It is certainly cheaper to remove the carbonate hardness with lime than with soap. Most of the cities that treat their water supply in this way do not attempt to remove all of the carbonate hardness as some consider it more palatable if all of the hardness is not removed. If the water is well aerated, this objection does not hold.

In addition to this there are other advantages to be gained in the water purification process itself by the use of lime, which is added primarily for the purpose of softening the water. We have in our own city a water system in which filtration does not play a part, and as a result there are times when this water is not perfectly clear. It is possible by using a sufficient amount of lime to remove a large portion of the carbonate hardness, to obtain a clear water even with a reduction of the amount of alum used for coagulation.

My attention was recently called to a small city having a complete equipment for treating a muddy river water with lime, coagulating it with alum, settling, filtering and sterilizing with chlorine. They were having difficulty in obtaining a clear water and the superintendent had used a considerable excess of alum attempting to coagulate this water and thus clarify it. It was found that by increasing the lime charge the amount of alum could be reduced and a much clearer water obtained than before. It is also worth noting that coagulated waters treated with lime show lower bacterial count than those where lime is not used, thus requiring a lower chlorine treatment.

The up-to-date industrial plant in this city has provided itself with a complete water softening equipment purely as a matter of economy without any coagulant other than the precipitates formed by the reaction between the lime and soda ash with the scale forming salts contained in the water. This applies to plants using raw Missouri River water as well as those using the clarified city water. Nor does this exempt the municipal industries themselves who have found it to their advantage to install such treatment. From this treatment a surprisingly clear water is obtained which gives little trouble in boilers from the formation of scale and which yields a substantial return on the investment in the efficiency of operation and economy in maintenance of the power plant.

I do not mean to advocate here that filters should not be used, I believe any city is entitled to the best water that can be produced and therefore believe in filtration following coagulation and softening with ample settling basins to clarify it. Such treatment greatly reduces the amount of filtering area required and therefore the initial cost of filters, as well as the operating cost.

There are many people who consider softening of a municipal supply an unnecessary refinement but I submit to you that if a water can be furnished with more than 50 per cent of the hardness removed, at a cost of from one to two cents per 1000 gallons, that such an operation would pay and be greatly appreciated by a large number of citizens. This method is particularly applicable to city plants where turbid waters are taken from the streams and clarified by coagulation and settling. The necessary softening equipment can be installed on such a plant at a nominal cost. I know of no improvement involving so small an expenditure that would meet with such universal approval in the community.